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ABSTRACT

A total of 135 high school students were tested to determine the relationship between IQ scores, frame length, and comprehension of material presented in a programmed instruction format. The students were divided into three groups according to IQ scores; students in each group were randomly assigned to receive a programmed lesson that had long, moderately long, or short instructional frames. Other than the length of the frames, the three lessons were identical. Immediately after the lessons were completed, the students were tested for comprehension of the material, which dealt with President Wilson's attempts to establish peace after World War I. Results indicated that certain students, e.g., those with low IQ scores, may benefit from programmed instruction, particularly if the frame lengths are relatively short. (Author/IS)

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The Effects of Student IQ and Programmed Instruction Frame Length on Social Studies Achievement

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Running Head: Effects of Frame Length and IQ

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Abstract

High school social studies students (n=135) were each placed into one of three groups (45 students per group) according to IQ (above average IQ, average IQ, below average IQ). Students in each of the three groups were then randomly assigned to receive either a programmed lesson that had long frames, or a programmed lesson with frames of moderate length, or a programmed lesson with short frames. Other than the lengths of the frames, the three lessons were identical. Immediately after the lessons were completed, the students were tested for comprehension of the material, which focused on President Wilson's attempts to establish peace after World War I. As expected, IQ significantly affected the test scores. The length of the frames also was significant, as was the interaction between IQ and frame length.

THE EFFECTS OF STUDENT IQ AND PROGRAMMED INSTRUCTION FRAME LENGTH ON SOCIAL STUDIES ACHIEVEMENT

Programmed instruction was primarily developed to solve the problem of differences in student learning rates and levels of prior knowledge. The word "program" is important. It denotes planned learning patterns. The program could be displayed in one of several different forms, such as books, audio or video tapes, films, or via computer software. The material to be learned is presented to the learner in a logical sequence. The program consists of a series of items called frames (Espich & Williams, 1967). These frames are arranged by the programmer so that the learner arrives at the desired outcome with a minimum of errors. This learning takes place bit by bit in such a way that the learner must respond to questions concerning each frame before he goes on to the next frame.

There are numerous advantages to programmed instruction. The most

obvious is that the learner experiences immediate feedback. There is no delay while the instructor grades the papers. Another advantage is that the learner can work at his own rate. He is not rushed to move on to the next frame until he is ready to do so. Green (1963) suggested that programmed instruction allows the teacher more freedom to pursue the more challenging aspects of teaching because he no longer needs to spend so much time teaching the basic facts; the programmed instructional unit takes care of that.

In the period from 1950 to 1970, there was a great deal of literature concerning programmed instruction. The advent of the micro-computer guarantees new interest in programmed instruction. While researchers have investigated programmed instruction and learning, there has been relatively little research concerning the effects of frame length and IQ on learning. Coulson and Silberman (1960) found that students who were given programmed instruction that involved short frames learned more than students whose programmed instruction involved longer frames. The effectiveness of smaller frames was also supported by Taber, Glaser, and Schaefer (1965). When larger frames were presented, the error rate for the learner was increased. Both of these findings were in accordance with Skinner (1958), who emphasized the importance of small frames in writing instructional units.

Concerning the effect of student intelligence level on learning via programmed instruction, Edling (1964) stated that programmed instruction can be used for students with various intelligence levels. For certain programs, slow learners (mean IQ=77) learned more than they had learned previously through traditional classroom teaching. O'Reilly (1969) reported that student IQ affected the rate at which students learned through programmed instruction, as well as the level of mastery the students achieved. Marshall

(1970) indicated that students of high intelligence tended to achieve regardless of whether the instruction was programmed or based on classroom lectures. However, some students of lower intelligence appeared to achieve more under programmed instruction. This finding was confirmed by Fryar (1971), who also found that students of high intelligence who were classified as low achievers scored significantly higher using programmed instruction than did a similar group of students that did not use programmed instruction.

A thorough review of the literature failed to identify studies that focused on both variables (frame length and student intelligence level). Therefore, the purpose of this study is to examine the joint effects of frame length and IQ on student learning in programmed instruction.

Method

Subjects

A total of 135 social studies students in a Richmond County (Georgia) public high school were selected for this study. Approximately 70% of the students were black and 30% were of caucasian ancestry. Approximately 50% of the subjects were females. Of the 135 students, 45 had Otis-Lennon IQ scores ranging from 110 to 144, with a mean IQ of 114. This group of students is referred to as the above average IQ group. A second group consisted of 45 students with IQ scores ranging from 87 to 106, with a mean IQ of 96. This group is referred to as the average IQ group. A third group was made up of 45 students with IQ scores ranging from 61 to 85, with a mean of 76. This group is referred to as the below average IQ group. Within each group of 45, students were randomly assigned to work on a programmed lesson that contained relatively long frames, or a programmed lesson containing frames of moderate length, or a programmed lesson that contained short frames

Therefore, a total of nine groups were formed with 15 student per group.

Procedure

Each of the three programmed lessons was identical except for the length of the frames. One lesson was made up of four frames. This lesson is referred to as the lesson with long frames. The second programmed lesson, which is referred to as the lesson with medium length frames, was exactly the same as the previously mentioned lesson, except that it was divided into eight frames. The third programmed lesson, referred to as the lesson with short frames, was the same as the other two lessons, but it contained twelve frames.

Each of the three lessons was begun with a discussion of President Wilson's plans for peace after World War I, and then discussed what went on in America and Europe before and during the peace conference in Versailles. Next, the lessons explained Wilson's attempts to persuade the Senate to ratify the Versailles treaty and the reasons why the Senate resisted Wilson. Then the lessons discussed how Wilson took his fight to the public and the occurrence of his stroke. Finally, a weak League of Nations was described, as well as the setting for a second world war.

The following excerpt shows the third frame of the lesson with longer frames. Corresponding questions and answers for this frame also are shown.

Frame 3

At the peace conference, the atmosphere was different. George Clemenceau of France, David Lloyd George of Great Britain and Vittorio Orlando of Italy did not agree with Wilson's fourteen points. France had hated the Germans since the Franco-Prussian War (1870-1871) and now, again, Clemenceau's country was in ruins because of the Germans. He wanted revenge. Lloyd George

favored anything that would add to the power and prestige of the British Empire. Orlando wanted to regain all of Italy's territory that had been lost to Austria. These three men, plus Wilson, were called the Big Four; it was they who drew up the Treaty of Versailles.

During the course of the Treaty Conference, Wilson was forced to give up point after point. But he struggled on and did succeed in getting the fourteenth point, the League of Nations. He felt that once the League got going, all of the world problems could be solved reasonably and peacefully.

When Wilson returned home, his next problem was to persuade two-thirds of the Senate to ratify the Versailles treaty, a task that would prove impossible. The "irreconcilables" led by Republican Senator, Henry Cabot Lodge, stood in the way. These Senators refused to ratify the Versailles Treaty until it was amended, particularly on the point of the League of Nations. In part their resistance was purely political, and in part it was in fear of a United States loss of sovereignty. Wilson refused to make any compromises on the League issue.

ANSWER THE FOLLOWING:

1. Match the following people to their countries:

_____ DAVID LLOYD GEORGE	A. ITALY
_____ VITTORIO ORLANDO	B. GREAT BRITAIN
_____ GEORGE CLEMENCEAU	C. UNITED STATES
_____ WOODROW WILSON	D. FRANCE

2. Lloyd George, Orlando and Clemenceau supported Wilson's fourteen points. True_____ False_____

3. At the peace conference, France wanted to gain revenge against another country. What was this country? Why did France want this revenge?

4. Italy's goal at the peace conference was to get land from _____.

5. Wilson, Clemenceau, Orlando and Lloyd George were known as the _____.

6. The only one of the fourteen points that was accepted was the:
(A) freedom of the seas _____ (B) reduction of arms _____
(C) League of Nations _____

7. In order to ratify a treaty, The Senate must approve it by
(A) 1/2 _____ (B) 1/3 _____ (C) 3/4 _____ (D) 2/3 _____ of the votes.

8. The "irreconcilables" were lead by _____.

9. The Senate was against the _____ section of the treaty.

10. The Senate was afraid that the United States would lose its _____ if it participated in the League of Nations.

ANSWERS

1. David Lloyd George was from Great Britain; Vittorio Orlando from Italy; George Clemenceau from France; Woodrow Wilson from the United States.

2. False. Every one of the leaders was against Wilson's fourteen points.

3. France wanted revenge against Germany because of the Franco-Prussian war and because Germany ruined France During World War I.

4. Italy wanted to get land from Austria.

5. Wilson, Clemenceau, Orlando and Lloyd George were called the Big Four.

6. C. The peace conference accepted the League of Nations. Great Britain was against freedom of the seas because it would cut their Naval Power. Everyone except the United States was against arms reduction.

7. D. (It takes 2/3 votes by the Senate to ratify a treaty.)

8. Senator Henry Cabot Lodge led the "irreconcilables".

9. The Senate was against the League of Nations Section of the treaty; they did not like the idea of the U.S. participating in such an organization.

10. The Senate was afraid the U.S. would loose its sovereignty if it participated in the League of Nations.

The lesson containing frames of medium length had frames approximately one half as long as the frame shown in the excerpt. Therefore, each of the exercises to check student comprehension contained about one half as many questions at a time. Similarly, the lesson containing short frames had frames approximately one third as long as the frame in the excerpt and had about one third as many questions per frame.

Although the lesson topic is a familiar one, none of the students selected for this study had received prior instruction concerning the content. The lessons were in booklet form. Each of the three lessons was begun with the instrucions that students were to work individually, and that they were to read the first frame and then turn to the questions for the first frame and answer them. Then they were to turn to the answers for these questions and check their progress. If they answered a question incorrectly, they were to read through the frame again until they identified the information that gave the correct answer. After they completed this process, they were allowed to advance to the next frame. When a student completed all the frames and the accompanying exercises, the student was administered a 20-item test. The test questions were similar to the questions in the previous exercises, except that the wording of the questions was modified, as was the question format. For example, if a question for a frame required the students to match items, a similar test question might require the student to write a phrase to complete a statement. Students were not given a time limit to complete the programmed lesson and the test, but all students finished within 65 minutes. The split-half reliability of the test was .84.

Results

A 3(frame length: long vs. medium vs. short) X 3(IQ: above average vs. average vs. below average) analysis of variance was performed on the posttest scores. Table 1 shows the means and standard deviations for the nine groups. Table 2 shows the results of the analysis of variance. The main effect due to frame length was significant, $F(2, 126) = 4.02$, $p < .05$. Tukey's (a) tests showed that students who studied under the short frame condition scored significantly higher than students who studied under the long frame condition. The short frame condition produced a higher mean achievement score than the medium frame condition, and the medium frame condition produced a higher mean than the long frame condition, but these differences were not statistically significant.

The main effect due to IQ was significant, $F(2, 126) = 20.46$, $p < .01$. Tukey's (a) tests showed no significant differences in above average IQ posttest scores and average IQ posttest scores. But students in both of these groups scored significantly higher than students with below average IQ scores.

The interaction between frame length and IQ also was significant, $F(4, 126) = 2.62$, $p < .05$. Frame length was not a significant factor for students in the average IQ group. For above average IQ students, the short frame length lesson produced a higher mean posttest score than did the medium or long frame length lessons, but the difference was not quite statistically significant. Similar results were obtained for the below average IQ students, with the mean posttest score for those who were given the short frames significantly exceeding the mean score for students given the long frames.

Values of omega squared are shown in Table 2. Frame length accounted for only 3.2% of the variance in posttest scores and the interaction between

frame length and IQ accounted for only 3.5% of the variance in scores. Student IQ accounted for 20.9% of the variance in scores.

Discussion

Caution must be exercised in interpreting the results of this study. First, the programmed lessons did not "branch" so that students who did not learn the material in a frame could go to new content covering the same material before going to the next frame. Instead, students were advised to read a frame again if they answered questions for that frame incorrectly. Second, the long-term effects of programmed instruction were not investigated in this study. For example, if long-term retention had been a dependent variable, the results may have been different. Finally, although frame length significantly affected the posttest scores, this variable is relatively weak, since it accounted for only 3.2% of the variance in the scores.

With these cautions in mind, the results of this study indicate that certain students (for example, those who have low IQ scores) may benefit from the use of programmed instruction, particularly if the frame lengths are relatively short. Of course, care in construction of programmed material at an appropriate readability level is critical.

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Table 1

Group Means and Stand Deviations

	Frame Length (A)			
IQ	Long (A_1)	Medium (A_2)	Short (A_3)	Totals
Above Average				
Mean	16.8	16.9	18.0	17.2
Standard Deviation	3.3	1.6	1.9	2.4
Average				
Mean	16.2	16.9	16.1	16.4
Standard Deviation	2.4	2.3	2.4	2.3
Below Average				
Mean	12.1	12.8	15.9	13.6
Standard Deviation	3.1	4.0	3.4	3.8
Totals				
Mean	15.0	15.5	16.7	15.7
Standard Deviation	3.6	3.4	2.8	3.3

Table 2

Results of Analysis of Variance

Source	df	SS	MS	F	w^2
Frame Length (A)	2	63.75	31.88	4.02*	.032
IQ (B)	2	324.55	162.28	20.46**	.209
A x B	4	82.96	20.74	2.62*	.035
Error	126	998.67	7.93		
Total	134	1469.93			

*$p < .05$.
**$p < .01$.